

Utilization of Double-Water-Chamber Seawall type for Wave Energy Extraction and Wave Dissipation

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Abstract-- Variation type and model of wave energy converter have been applied in many countries around the world in order to harvest the ocean wave power. A number of other devices were developing and testing by researchers in the experimental scale. In the present paper investigates double-water-chamber seawall performance for wave energy converter. The main body of water chamber seawall is like OWC structure. Savonius water turbine and guide vanes used to extract a wave power instead of air turbine as usually used in the OWC type wave converter. The Savonius water turbine with two blade type was chosen in this study and a guide vanes to guiding the water flow to accelerate the water turbine was applied. Application of double-water-chamber seawall is also intended to reduce the reflection wave. The performance of double-water-chamber seawall was tested in the flume tank in order to obtain the efficiency rate and reflection coefficient.

Index Term-- Double-water-chamber type Seawall, Savonius Water Turbine, Guide Vanes, Wave Energy Extraction, Reduce Reflection Wave.

1. INTRODUCTION

Utilization of wave power to meet the energy demand begins in 1973, the year of the so-called oil crisis. After that many researchers pays attention to develop the wave energy converter to utilize the wave power [1]. Actually, the ocean has been providing the energy from the sea wave power and it's enough to supply the electricity demand to support human activities. The limited negative environmental impact of its exploitation is a motivation for the use of wave power and development of wave power devices [2]. Compare to the wind and solar power device that can generate power to 20-30 percent only, the wave power devices can generate power up to 90 percent of the time [3]. Moreover, the density of water is 850 times as dense of air, it allows more energy can be

generated from the waves and the space of wave energy installation need 1/200 the land area only of wind and requires no access road. Based on the global status report, renewable energy accounted for only ~22.1% of global electricity production at the end of 2013 [4], and there is thus a great possibility to increase the supply of wave power, especially ocean wave power.

Many countries have used ocean wave power to meet electrical demands. Various wave power converters have been used to increase the wave power supply, and many other different technologies are under investigation and development [5]. One of the most popular systems used to extract wave energy is the oscillating water column (OWC). The OWC comprises a partially submerged chamber and an air turbine as an energy extraction device. As the oldest water converter device type, so many researchers have investigated the ability of an OWC model to extract energy from ocean waves [6-15]. However, from the point of view of the efficiency of wave energy conversion, an OWC plant does not perform as well as other renewable-energy plants, such as wind power plants and tidal power plants. Despite the low efficiency of the OWC, the OWC plays other important roles in addition to extracting energy, such as the role of a breakwater that protects an area behind. It is thus necessary to consider the multiple roles of the OWC in developing a more effective wave power plant in the future.

The present paper introduces and examines the development of a new wave power converter called the double-water-chamber seawall. It has developed from the previous work by Husain et al [16]. Although there is a lack of references for this type of wave converter, it has a shape similar to that of the OWC structure. Water turbine was used to extract the wave power instead of air turbine as usually uses in the OWC type. An axisymmetrical guide vanes were